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(54) Enabling utilisation of full engine power during acceleration in motor vehicles

(57) A method and a device for enabling utilisation of full engine power during acceleration of motor vehicles equipped with a generator which is driven by the engine of the motor vehicle. Includes an acceleration detector which controls the regulator of the generator such that the supply of current to the excitation winding is entirely or partially interrupted. Hence the generator load is removed and the power can be used to accelerate the motor vehicle. The device for electrically switching-off the generator can be of electro-mechanical or electrical construction.

FIG.1

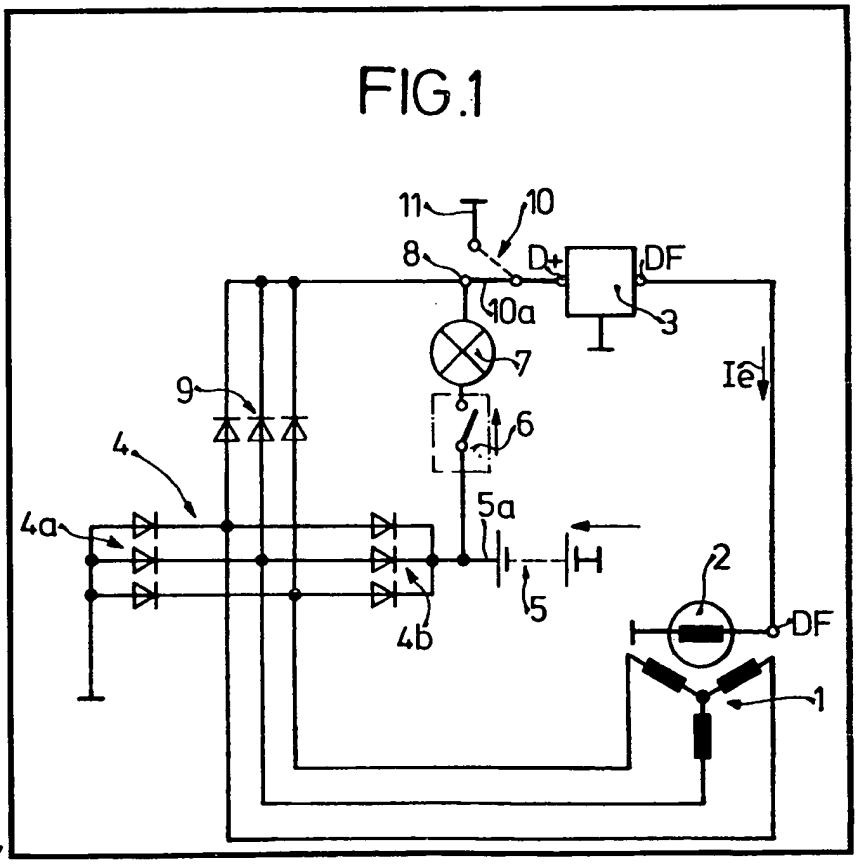

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FIG.1

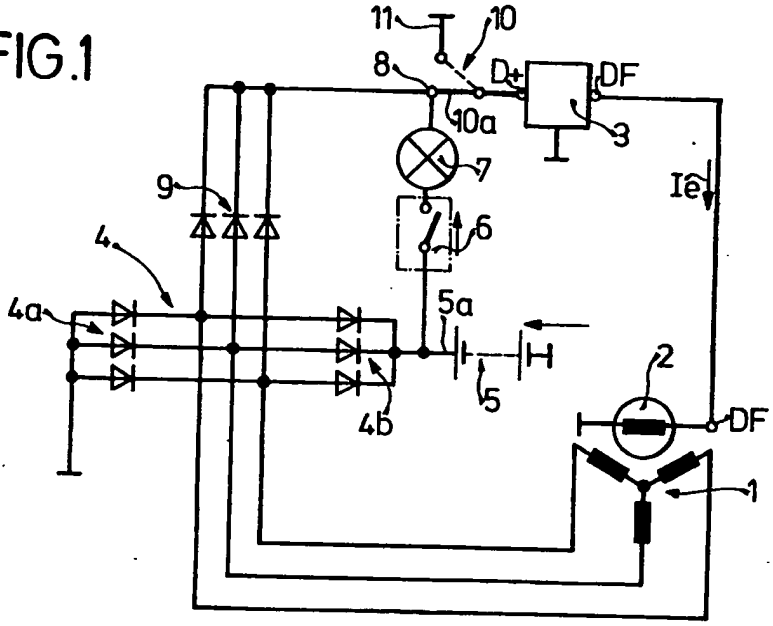


FIG.1a

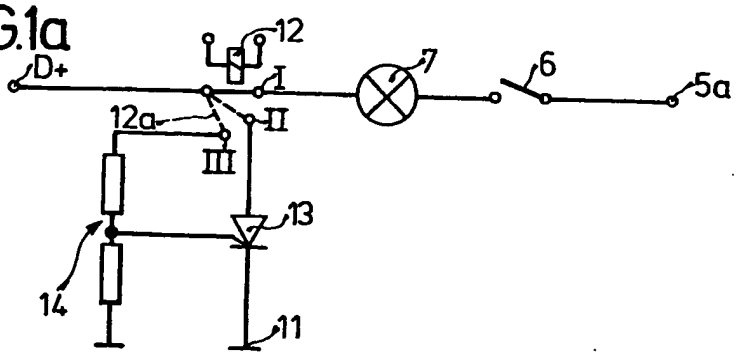


FIG.2

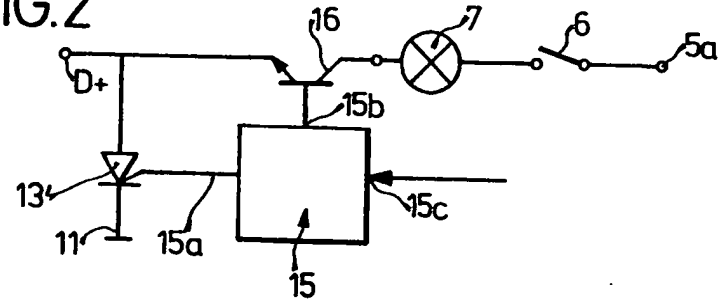


FIG.3

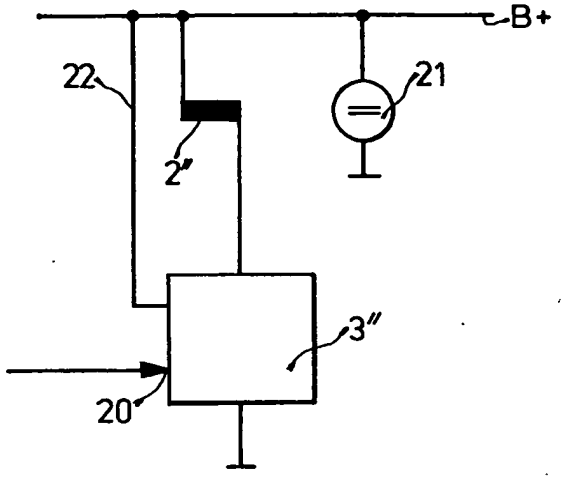
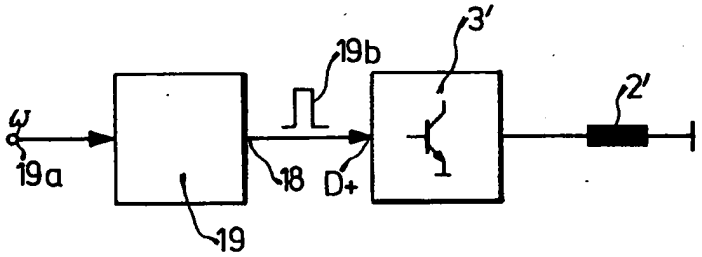


FIG.4



SPECIFICATION

Method and device for enabling utilisation of the full engine power during acceleration operations in motor vehicles

The invention is concerned with a method and a device for enabling the full engine power of motor vehicles to be used during acceleration.

In modern vehicles or similar mobile units, it is known that a considerable portion of the power generally produced by the engine, normally an internal combustion engine, is not available for the drive but is consumed by a large number of secondary units. A secondary unit of this kind, which is continuously driven and which therefore continuously consumes power, is the generator (normally a three-phase type) which can exhibit an unfavourable characteristic precisely in the upper range of speed. In specific types of engines, the electrical power converted by the generator at full load can amount to 4 horse-power or even more.

In accordance with a first aspect of the present invention, there is provided a method for utilising the full engine power during acceleration operations of motor vehicles and the like equipped with an electrical generator which is driven by the engine of the motor vehicle and which has a regulated supply of current to an excitation winding, wherein a positive acceleration of the engine exceeding a predetermined value is detected mechanically or electrically and the regulated supply of current to the excitation winding of the generator is interrupted or switched to a minimum duty ratio by an electrical signal, so as to deactive the generator during such acceleration.

In accordance with a second aspect of the present invention, there is provided a device for enabling the utilisation of the full engine power during acceleration operations of motor vehicles and the like equipped with an electrical generator which is driven by the engine of the motor vehicle and which has a regulated supply of current to an excitation winding, comprising a sensor which detects a positive acceleration exceeding a predetermined value and produces an electrical signal which is fed to a switching device adapted to interrupt the excitation current of the generator or to switch the excitation current of the generator to a minimum duty ratio.

The aforegoing method in accordance with the invention has the advantage that electrical switching-off of the generator can release the full engine power for driving the motor vehicle when this is urgently required, namely during conditions of maximum acceleration. Maximum acceleration operations of this kind often occur during overtaking, it being no longer possible to break off the overtaking operation without the probability of an accident upon exceeding a specific instant during the overtaking operation and on coming traffic suddenly appears. Under such conditions, all the reserves of power of the engine are required in order successfully to conclude the overtaking operation by maximum forward acceleration, and it is thereby advantageous to obtain additional, appreciable reserves of power by switching off the generator.

Although the generator does not supply current when it is switched off during the period of maximum acceleration of the motor vehicle, this is of secondary importance since:

(a) the battery which is always provided can fully supply the current, since it is in any case in a satisfactorily charged state during travelling operations in which maximum accelerations of this kind occur, provided that the motor vehicle has already been operated for a predetermined period of time;

(b) the generator is in any case only switched off for the period of acceleration and, when the full power of the drive engine is no longer required, the battery is subsequently charged again as necessary; and

(c) maximum acceleration operations of this kind occur relatively infrequently.

However, when maximum acceleration of this kind is required, the invention takes effect and makes available an additional reserve of power which can amount to 10% and, if required, in excess thereof, in the case of low power motor vehicles. The invention involves simple construction and can be used inexpensively even in existing types of motor vehicles.

It is particularly advantageous that it is possible to switch off the generator electrically by short-circuiting the input terminal of the regulator, which is designated D + in Germany, by means of a switch which responds when the accelerator pedal is fully depressed, whereby the generator is de-energised. This facility is of very simple construction and is particularly inexpensive.

The invention is described further hereinafter, by way of example, with reference to the accompanying drawings, in which:–

Figure 1 and Figure 1a illustrate two embodiments of the present invention based on electro-mechanical and semi-electronic principles, respectively;

Figure 2 illustrates a third embodiment of the invention in which the generator is de-energised by electronic means; and

Figures 3 and 4 illustrate a method of switching off the generator wherein a switching signal for the regulator is produced by detecting the speed of the generator or of the internal combustion engine.

The basic proposal resides in making additional power available under full acceleration in a motor vehicle having a generator by entirely or partially switching off the generator driven by the engine. The generator is switched off electrically, specific positions of

the accelerator pedal or speeds of the internal combustion engine being evaluated as a criterion for establishing the condition of maximum acceleration.

To improve comprehension, one possible embodiment of a generator, in the form of a three-phase generator, in a motor vehicle will be briefly discussed, although it is pointed out that the basic idea of the present invention can be applied to any generators which have an excitation current terminal. The basic construction of a three-phase generator is such that the rotary-driven rotor 2 is associated with a three-phase stator winding 1 in the form of a fixed conducting member, the rotor 2 being fed with an excitation current Ie regulated by a regulator 3. The regulator 3 can be an electromechanical contact regulator or, preferably, a transistorised regulator whose output terminal DF is connected by way of a slip ring and carbon brush system to the excitation winding which, alternatively, however, can be stationary in special types of construction. The arrangement is completed by a rectifier bridge 4 which is connected to the three phase-windings of the stator and which, for example, comprises three negatively conducting diodes 4a and three positively conducting diodes 4b, the latter being connected to the positive pole 5a of the vehicle battery 5. The further external circuit can include an operating switch 6 and a charging indicator lamp 7, the non-regulated excitation current being fed to the circuit point 8 by way of separate excitation diodes 9 in the embodiment illustrated in Fig. 1. The circuit point 8 is normally connected to the input terminal D + of the regulator 3. Upon starting a three-phase generator of this kind, a preexcitation current flows from the positive terminal 5a of the battery to the excitation terminal D + by way of the charging indicator lamp after the operating switch 6 has been closed, and thus initiates the self-excitation of the generator.

In accordance with the first embodiment of the invention illustrated in Fig. 1, which relates to an electro-mechanical solution, the electrical switching-off of the generator is effected in that the generator or the dynamo is short-circuited at the terminal D + and is thus de-energised. The terminal D + generally designates the input terminal of the regulator, but at all events designates a generator terminal through which the excitation current of the generator flows and which, when it becomes currentless, effects the electrical switching-off of the generator. For this purpose, in the illustrated embodiment, a switch 10 is provided whose switch arm 10a when in its normal position connects the circuit point 8 to the input terminal D + of the regulator but which, as is shown by broken line, is switched to earth 11 so that the terminal D + is short-circuited, during the period of maximum acceleration of the motor vehicle for the purpose of releasing additional engine power. By way of example, the switch 10 can be actuated by a so-called kick-down switch which is always provided in motor vehicles equipped with automatic gear boxes. Alternatively, however, other switches can be used disposed in the region of the accelerator pedal. In any such case the switch can be operated directly or by means of a relay.

Relay actuation of the latter kind is illustrated in Fig. 1a together with further circuit elements which will be discussed hereinafter and which render possible currentless switching-on and switching-off. The relay 12 has at least one winding which is controlled by, for example, the kick-down switch or by some other optional switch.

Referring to Fig. 1a, the switching arm 12a of the relay has three different relay positions I, II, III. The relay position I corresponds to the normal position in which the generator terminal or the input terminal D + of the regulator is connected by way of the closed operating switch 6 and the charging indicator lamp 7 to the positive pole 5a of the battery or to some other available potential which can also originate from, for example, the excitation diodes 9. When the relay 12 is activated, the switching arm 12a in the first instance moves into the switching position II and thus isolates the terminal D + from the source of power for the excitation current. At the same time this results in a connection to the switching path of a thyristor 13 or some other suitable electrical or electro-mechanical circuit element which, however, in the first instance does not close the current connection to the earth terminal 11. After the circuit element (thyristor 13), which is still non-conductive, has been connected to the terminal D + it is triggered after a short time lag, i.e. in the illustrated embodiment the thyristor 13 is fired, by virtue of the face that the contact is also moved into the switching position III as well as retaining the switching position II, and firing current is thus fed to the thyristor by way of the voltage divider 14.

A circuit of this kind ensures currentless response of the circuit components, that is to say, the relay 12 in the present instance, since the thyristor 13 is still non-conductive upon energisation of the relay 12 and the switching position II is changed over in a currentless manner. At the same time, currentless switching-off of circuit, i.e. the relay 12, is rendered possible, since, upon the switching-off of the circuit arrangement, the terminal D + is still dead and it is only after changeover to switching position I that the potential at the terminal D + rises as a result of self-excitation of the generator.

In a preferred embodiment, the relay 12 can have a current winding in addition to the voltage winding controlled by, for example, a

kick-down switch (not illustrated). It is thereby possible, by appropriate design of the relay 12, to switch off the generator and thus to switch on the power released thereby, only when a specific current is flowing from the generator, in other words, when the generator supplies corresponding electrical power and requires mechanical power for driving it.

In the embodiment of Fig. 2, the electrical switching-off of the generator is effected by electronic means, for which purpose there is provided an electronic control circuit 15 whose outputs 15a, 15b are connected respectively to a thyristor 13', which has already been mentioned with reference to Fig. 1a and which short-circuits the terminal D+ to earth, for the purpose of triggering the thyristor 13' and to a circuit element 16 which is preferably in the form of a semiconductor and which interrupts the connection between the terminal D+ and the positive pole 5a of the battery by way of the charging indicator lamp and the operating switch. The control circuit 15 is triggered at the input 15c with a suitable input quantity which can originate from, for example, the kick-down switch already mentioned or, alternatively, from the output terminal 18 of a differentiator 19 which is shown in Fig. 4 and which supplies a switching-off signal for the three-phase generator by detecting the rotational speed of the generator or of the internal combustion engine.

This possibility, just mentioned, of switching-off the generator by detecting the rotational speed, as is illustrated in Fig. 4, can be effected by differentiating a speed signal instead of the signal supplied by a kick-down switch or some other switch, since a control signal for the generator corresponding to the maximum acceleration of the motor vehicle can be readily obtained by differentiating a speed signal. By way of example, the speed signal fed to the input terminal 19a of the differentiator 19 (Fig. 4) can be obtained by connecting the input terminal 19a to a phase terminal on the generator, or to the ignition terminal of the motor vehicle or to a tachometer. The differentiator is constructed such that, at maximum acceleration, it supplies an output signal 19b which can be produced by a trigger stage (not illustrated) which is connected to the output of the differentiator and which responds to this maximum positive acceleration. The regulator is illustrated diagrammatically at 3' and, upon the appearance of a signal 19b indicating a high positive acceleration, entirely or partially switches the field winding 2' of the generator to a currentless state, whereby the generator is de-energised.

Referring to Fig. 3, the regulator can be partially blocked in this manner by intervention in a correspondingly constructed regulator 3'' to the input 20 of which is fed a corresponding signal indicating high positive acceleration. This signal can be obtained in an optional manner as already mentioned above (kick-down signal, differentiated speed signal or the like). Upon the appearance of such a signal, a regulator can be switched to interrupt the field winding 2'' (Fig. 3) or, alternatively, it is also possible to switch the regulator to a minimum duty ratio with respect to the excitation current supplied to the field winding 2' by the regulator, so that (for example in the absence of a battery), the power supply for the ignition operation is always ensured. The generator is designated 21 in Fig. 3. The generator output carrying positive voltage is designated B+ in a conventional manner. Alternatively, as already mentioned above, separate excitation diodes can be omitted and the potential required for regulated control of the field winding 2' is fed to the regulator 3' from the positive terminal B+ by way of a connection lead 22.

CLAIMS

1. A method for utilising the full engine power during acceleration operations of motor vehicles and the like equipped with an electrical generator which is driven by the engine of the motor vehicle and which has a regulated supply of current to an excitation winding, wherein a positive acceleration of the engine exceeding a predetermined value is detected mechanically or electrically and the regulated supply of current to the excitation winding of the generator is interrupted or switched to a minimum duty ratio by an electrical signal, so as to deactivate the generator during such acceleration.

2. A method as claimed in claim 1, in which a connection terminal (D+) carrying the excitation current is short-circuited to earth upon the occurrence of the acceleration exceeding said predetermined value, to thereby de-energise the generator.

3. A method as claimed in claim 1 or 2, in which said predetermined acceleration value is detected by means of a switch actuated in response to a predetermined movement of the accelerator pedal or by differentiation of a rotatonal speed signal.

4. A method as claimed in any of claims 1 to 3, in which the generator is switched off by feeding to the regulator a signal indicating maximum acceleration, such that the regulator interrupts the excitation current of the generator or switches it to a minimum duty ratio.

5. A device for enabling the utilisation of the full engine power during acceleration operations of motor vehicles and the like equipped with an electrical generator which is driven by the engine of the motor vehicle and which has a regulated supply of current to an excitation winding, comprising a sensor which detects a positive acceleration exceeding a predetermined value and produces an electrical signal which is fed to a switching device

adapted to interrupt the excitation current of the generator or to switch the excitation current of the generator to a minimum duty ratio.

6. A device as claimed in claim 5, in which the switching device for interrupting the excitation current is a kick-down switch associated with the accelerator pedal of the motor vehicle or some other switch which responds to acceleration and which short circuits a generator terminal (D +), carrying the excitation current, to earth.

7. A device as claimed in claim 5, in which the switching device is a relay which is actuated by the output signal of the sensor and which has a switch for interrupting the excitation current.

8. A device as claimed in claim 7, in which the relay switch is switchable from its normal position into two further switching positions which are separated by a short time lag, such that the connection terminal (D +) carrying the excitation current is in the first instance connectible to a blocked switching element connected to earth, the switching element subsequently being switchable to its conductive state in the third switching position of the relay for the purpose of currentless switching-on and switching-off of the relay contacts.

9. A device as claimed in claim 6, in which the switch which can connect to earth the terminal (D +), which carries the excitation current of the generator is a thyristor.

10. A device as claimed in claim 9, in which the thyristor is switched to its conductive state by means of an electrical control circuit to which the electrical acceleration signal is fed, and in which there is provided a further contact-breaker switch which is arranged in a lead connecting a charging indicator lamp to the connection terminal (D +) of the generator and which is conductive when the thyristor is blocked.

11. A device as claimed in one of the claims 5 to 10, in which in order to obtain an acceleration signal for the switching-off of the generator, there is provided a differentiator to the input terminal of which is fed a rotational speed signal and whose output signal is fed, by way of a trigger stage which responds to maximum positive acceleration, to the regulator of the generator such that the generator field winding is switched off or is switched to the minimum duty ratio of the excitation current.

12. A method for enabling the utilisation of the full engine power during acceleration operations of motor vehicles and the like, substantially as hereinbefore described with reference to the accompanying drawings.

13. A device for enabling the utilisation of the full engine power during acceleration operations of motor vehicles and the like, substantially as hereinbefore described with reference to the accompanying drawings.

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